UNITED STATES DISTRICT COURT
DISTRICT OF SOUTH DAKOTA
SOUTHERN DIVISION

SIOUX STEEL COMPANY, a South Dakota corporation,

Plaintiff,

vs.

KC ENGINEERING, P.C., an Iowa corporation,

Defendant.

Civ. 15-4136

AFFIDAVIT OF JOHN W. CARSON

STATE OF MASSACHUSETTS)
:SS
COUNTY OF MIDDLESEX)

I, John W. Carson, being duly sworn on oath, depose, state, and declare as follows:

1. I have been retained as an expert witness on behalf of KC Engineering, P.C. ("KC Engineering").

2. I am Chairman of the Board of Jenike & Johanson, Inc. ("J & J"), an international engineering consulting firm.

3. At no point have I ever had personal contact with Sioux Steel Company ("Sioux Steel") or any of its representatives or employees prior to the commencement of this litigation.

4. In October 2016, I was contacted on behalf of KC Engineering with the intent of being retained as an expert witness in this matter. As part of J&J's standard operating procedure, I immediately ran a conflict check.

5. The conflict check resulted in my finding an entry in our Client Resources Management software that summarized several communications between J & J and Chad Kramer ("Kramer") of Sioux Steel in July 2012.

6. This entry, attached hereto as **Exhibit A**, is the only document or record retained by J & J that relates to the communications between J & J and Kramer in July 2012.

7. The first set of communications consisted of three emails between Kramer and J&J's Thomas Baxter on July 17, 2012. The second communication consisted of a phone conversation between J&J's Gregory Petro ("Petro") and Kramer on July 19, 2012. I was not aware of nor was I involved in any of these communications.

8. I have no personal knowledge of what documents, plans, or designs, if any, that Kramer sent to J & J in July 2012. Other than Exhibit A, J&J did not retain any other documents or records.

9. Petro died in November 2014 – almost two years before I was approached to be an expert for KC Engineering in this matter. As a result of Petro's passing, there is no way for me to obtain any more information about the communications between J&J and Kramer than that contained in Exhibit A.

10. At no time before or after these brief communications between Sioux Steel and J&J in July 2012 did J & J ever have any other contact with Sioux Steel.

11. I did not learn about J & J's July 2012 communications with Sioux Steel until I received the results of the conflict check described above.

12. Since Kramer's communications with J & J occurred years prior to this litigation, there were obviously no discussions regarding litigation strategies, litigation theories, potential litigation witnesses, or the strengths and weaknesses of the case.

13. I am not a member of the National Society of Professional Engineers.

14. I do not have formal education in structural engineering; however, I do have nearly five decades of direct experience in and have written extensively on issues relating to forces exerted on bins and silos by the contents of these structures and the response of such structures to those forces. In addition, I have extensive prior experience with grain bins and related agricultural storage structures. This includes investigating the collapse of well over 50 grain bins during my career.

15. Analysis of the forces exerted on storage structures in a wide range of industries (mining, chemical processing, power, agricultural, etc.) has been one of the main focuses of my engineering career. I have delivered lectures on this subject at various engineering meetings across North America and in several foreign countries. In addition, I have presented short courses on this subject to mechanical and structural engineers at J&J client firms.

16. There is no bin design code in existence in the U.S. or internationally that deals with material-induced forces on bins and other storage structures when storing non-free-flowing materials. Based on my experience and training, the appropriate steps that an engineer should take when dealing with storage and flow of non-free-flowing materials involve: (1) altering the geometry and/or material of construction of the hopper (i.e., sloping portion of the bin) or eliminating the hopper altogether and using a flat bottom with an unloader that activates the full cross-section of the bin; (2) making operational changes to control the moisture, oil content, temperature, etc. of the potentially non-free-flowing material before it is placed in a bin so as to ensure that it is free-flowing; (3) continuously moving the material to prevent caking; and/or (4) adjusting the size of the bin to reduce pressures acting on the material to an acceptable level.

17. ANSI/ASAE EP 433 ("EP 433") specifies material-induced loads exerted on the walls of bins that discharge in a funnel flow or plug flow pattern. Using EP 433's definitions of these flow patterns, the bin at issue in this matter discharged via funnel flow.

18. Paragraph 5.1.2.1 of EP 433 states that material-induced loads exerted on the walls of bins discharging in a funnel flow pattern can be predicted by using Janssen's equation (Equation 2 in paragraph 4.1.1) and that "overpressures are not generated".

19. The title of EP 433 is "Loads Exerted by Free-Flowing Grain on Bins". (Emphasis is mine.) The purpose of this document is stated in paragraph 1.1: "This Engineering Practice presents methods of estimating the grain pressures with centrally loaded and unloaded bins used to store free-flowing, agricultural whole grain".

20. Soymeal is not an agricultural whole grain; therefore, EP 433 is not an appropriate document to use when calculating loads exerted on the walls of a bin used to store it. In addition, soymeal is often non-free-flowing – something that is well known and understood in the agricultural industry. This is another reason why EP 433 is not applicable to bins designed to store soymeal.

21. Paragraph 5.4.2 of EP 433 states that when grains stored in a bin absorb moisture, there is an increase in bin wall pressure. To prevent this, EP 433 recommends that grain bins be "designed, located and managed to prevent grain moisture contents from increasing more than one or two percent during storage". It follows that, if an agricultural whole grain were to become non-free-flowing (e.g., due to an increase in moisture of more than a one to two percent), EP 433 would no longer be applicable.

22. Analysis of the hopper section of the bin at issue indicates that its upper portion was under-designed to meet proper safety factors; however, it was not under-designed to the point that failure would be predicted when it was loaded.

23. The bin at issue did not fail after it was filled nor while it remained full for approximately four days prior to it being discharged. This proves that, even though gravity-induced loads likely over-stressed the upper portion of the hopper, it was not stressed to a point of failure. In other words, the design flaws in this bin ate up some of the safety factor, but they were not the cause of its failure.

24. Because the bin at issue did not fail from gravity-induced loads, loads greater than those imposed by gravity must have been present. These so-called dynamic loads caused it to fail.

25. One means by which dynamic loads can develop in a bin is by collapse of an arch or rathole. This condition can only occur in a bin that empties via funnel flow if the material is non-free-flowing.

26. Another means by which dynamic loads can develop in a bin is by the firing of air cannons.

27. Had the material in the bin at issue been free-flowing, there would have been no dynamic loads from a collapsing arch or rathole nor would there have been any need to mount or fire air cannons. Thus the bin would not have failed.

28. The failure of the bin at issue started at the bottom of the hopper. Since this portion of the bin was not under-designed for gravity-induced loads, this is further proof that the cause of failure was dynamic loads.

29. Had the mathematical errors that caused the upper portion of the hopper to be under-designed been remedied prior to the bin being filled then discharged, the bin would still have collapsed. This is because its design did not take into account the storage of soymeal, a non-free-flowing material.

30. I incorporate my original and supplemental reports as well as my deposition testimony in this affidavit. My reports amply illustrate and explain: (1) why the bin at issue collapsed; (2) why soymeal is not a free-flowing agricultural whole grain, thus rendering EP433 inapplicable; and (3) my frame-by-frame study and analysis of the security footage that captured the collapse of the bin which shows that the failure began at the bottom of the hopper and not in the upper portion of the hopper. My analysis of the security footage is in agreement with the analysis performed Rodney Nohr, a South Dakota engineer hired by Sioux Steel who visited the scene of the accident shortly after it happened.

Dated this 29th day of March 2018

John W. Carson

Subscribed and sworn to before
me this 29 day of March 2018

Notary Public – Massachusetts
My Commission Expires: 11/11/2022